The Open University

S103 Discovering science

Assessment Booklet 1

(February 2007 Presentation)

Contents

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13.1

General advice about S103 assignments: Part 1

This preface to the Assessment Booklet provides some general guidance on how to approach the early tutor marked assignments (TMAs) in S103. You should read Part 1 of this advice *before* you tackle TMAs 01 and 02. Also make sure you read Part 2 (see page 7 of this booklet) before you start TMA 02.

When and how to start work on a TMA

At the front of each TMA, we indicate which blocks the questions are assessing, and you will probably find it useful to read through the assignment questions for a block *before* you begin detailed study of the block.

When is the best time to do the questions that relate to a particular section or block? One approach would be to begin them straight after you have studied the relevant course material. However, we recognize that you may well find it difficult always to put this approach into practice! Another approach is to wait until you have finished a particular block and can see the material in a broader context. If you do this, you will need to build in plenty of time to your study schedule to complete the TMA. You may be tempted to leave your assignments until just before the cut-off date, thinking that the longer you leave it the better you will understand the course material. Try to avoid this — it is far better to organize your time so that you make a first attempt at assignment questions when you have completed the relevant section or block and when the material is fresh in your mind. Even if you don't have time to answer a question properly, you will find it useful to make some notes relating to the question immediately after studying the relevant material. You can then complete your answers later on.

As well as their role in assessing your progress through the course, all questions have various other goals – to help you to reinforce your understanding of concepts, practise certain skills, or make links between the different components of a block or between different blocks.

The Sciences Good Study Guide (*SGSG*) Chapter 9, Section 6 contains more detailed advice on assignments, and we recommend that you read this before you tackle TMA 01, and that you revisit it before you tackle TMA 02.

Answering the question

Tutors will always tell you that more marks are lost in assignments by students failing to answer the question in the way that is asked than for any other reason. Questions are carefully worded to elicit specific answers. You should not regard them as an opportunity to write everything you know about a topic. The following guidelines should help, and more detailed advice is given in *SGSG* Chapter 9, Section 5.2.

- Look to see which learning outcomes for the block(s) are being assessed (i.e. which objectives are listed at the start of the question).
- Read the whole question very carefully before starting to answer any part and make sure that you understand what is being asked for. If you are uncertain, you can always discuss the wording with other students or with your tutor.
- Check the meanings of any words that you are uncertain about by using the *Course Glossary* or a dictionary.
- Pay particular attention to any words that have been *italicized* for emphasis.

- Follow the instructions. If asked for a diagram or table you will lose marks if you do not include one. If asked for *four* reasons you will lose marks by giving three, and waste your effort by giving five.
- Take careful note of words like 'describe', 'explain', 'list', 'sketch' and 'briefly'. They are used for good reasons. When you come across such terms, stop and think through what they mean in practice as you work on your TMA.
- To decide how much detail you should include in an answer, look at the number of marks allocated. A short answer will obviously have fewer marks allocated than a detailed description or complex calculation.
- Attempt all parts of a question and make sure that your answers are clearly marked with the question number and the part.
- Before sending a TMA off to your tutor for marking, always read through your answers carefully and check them against the question to make sure that you have not missed anything.

Presenting answers to calculations

It is important to present your answer to a calculation in such a way that your tutor can understand fully how and why you arrived at your answer. Your tutor can then assess whether you know what you are doing when you get the correct answer (and so see that it wasn't pure guesswork!). Your tutor can also see the source of any errors and so explain to you where you have gone wrong. The details that we expect of you in calculations are important aspects of communicating through mathematics. *Usually more marks will be awarded for the steps in a calculation than for the final answer*. Showing all the steps in your working will help you, too. It will keep your thinking clear as you do the question and will make your answer easier to check when you have finished. It will also enable you to understand what you did if you look back at your calculation in the future, for example when presented with a similar one in a later assignment.

It is worth bearing in mind the following guidelines whenever you present the answer to a calculation.

1. Set out your answer clearly with words of explanation as appropriate — the answers to questions in the S103 books provide a model to follow.
2. Include *all* the steps in a calculation:
   - first write down any equations you are using, and define the terms that you use in the equations;
   - then write down the numerical values (with units) of the quantities in the equation;
   - then write the equation with the numerical values and units in it;
   - next write down any intermediate steps in the calculation;
   - finally write down the answer with the correct unit and the correct number of significant figures (not required in TMA 01).
3. Remember to use scientific notation and SI units where appropriate.

In the early assignments we will generally remind you of these points in a question as appropriate. But even when we do not, for example, say 'show your workings', you should *always* follow the guidelines above.

Writing explanations and descriptions

We generally give some guidance on what length of answer is appropriate. For short written answers, the advice is usually given in terms of the number of sentences or words. For longer answers, we indicate the number of words that is appropriate. If the question states, for example, 'about 100 words', you should use the number of words as a *guide* to the amount of information and type of answer required, and should bear in mind the advice about producing written work given in Block 1, Sections 5 and 6. If your answer is much shorter than the number of words indicated in the question, you are likely to have omitted some important information. If your answer greatly exceeds the suggested length, you may have included irrelevant information and your answer may lack clarity. In this case you are likely to lose some of the marks awarded for 'quality of writing'. It will greatly help you, and your tutor, if you give a *rough* indication at the end of each answer of the number of words used. We will tell you explicitly in a question if you will be penalized for exceeding a specified word limit.

For many written answers, marks will be awarded for the 'quality of writing', i.e. for paying attention to the advice given in Block 1 Section 5 on the 'three Cs', including your use of English (i.e. sentence construction, appropriate use of paragraphs, and spelling).

Planning a written answer

For TMA 01 you are asked to produce a fairly short piece of writing that describes or explains some science in your own words. The skills required for this written answer are developed in various activities in the *Study File for Block 1*, and we have also recommended appropriate sections of *SGSG* for you to read. In TMA 02 you are expected to produce a somewhat longer, more structured piece of writing, and you may be required to put together information from different course components. Because your tutor will be providing feedback (TMA 01) or awarding marks (TMA 02) for the structure and clarity of your writing, as well as for the scientific content, some additional advice is appropriate.

The first thing to do when tackling a TMA question that requires you to produce a piece of scientific writing is to *follow the advice that we have already given*, and in particular to *read the question carefully* to make sure that you are clear about what you are being asked to do.

The next stage is to *look back over all the relevant course material* (not just the book(s)) and to *make very brief notes* of any concepts, examples, etc. that you might include in your answer. You shouldn't write down every detail at this stage, because you may decide later that it is not appropriate to include some things. But don't forget to make a note of *where* you found each item of information (e.g. page number, section of DVD-ROM) as you might need to go back later to check on details.

You should then *make a rough plan of your piece of writing*. This should indicate *what* information you are likely to include, the *order* in which you intend to present the information, and the *point* that you intend to make with it. You can produce a plan that is a list of topics, with an indication of the appropriate order, or you may prefer to produce your plan as a diagram of some sort. Remember that your plan is primarily for your own use and so it does not have to be well presented. You are likely to have second or even third thoughts as you plan your work, so your plan may have many crossings out. If you decide to change the order in which you present your points you will probably have arrows to show this on your plan. You may prefer to draw up your plan in pencil, and to have an eraser handy, or you may prefer to use a word processor to produce a plan that

forms a template for your piece of writing. *SGSG* Chapter 9, Section 5.3 has more detailed advice on producing a plan for what you are going to write, and we recommend that you read this before attempting TMA 02.

You will then be in a position to *produce a first full draft* of the actual piece of writing. If you find this hard, don't worry. Putting your thoughts about a difficult subject down in writing for others to read *is* a hard task. While it undoubtedly does get easier with practice, very few people can simply sit down and let the words flow effortlessly. You should find that *SGSG* Chapter 9, Sections 3 and 5.1 provide valuable help with 'putting an answer together'.

One thing to remember is that, unless told otherwise, you are expected to produce a piece of *science* writing that shows your tutor that you understand the concepts. It is therefore important that you use and *spell* scientific terms correctly; *SGSG* Chapter 9, Section 4 gives some guidance on this.

Finally, it is worth organizing your work schedule so that you can put your first draft aside for a few days before you produce the final version that you submit. Possible improvements will be far more obvious when you read the draft again with a fresh eye, and this will make it a lot easier to produce the final version to send to your tutor.

Including diagrams

In the early assignments we will tell you when to include a diagram as part of your answer and will give you advice on what the diagram should show.

You should produce your diagrams *by hand*, unless instructed otherwise. You should not use a computer to draw your diagrams. Hand-drawing helps you to develop a critical awareness of the most appropriate way to illustrate your TMA answers, unhampered by the limitations of your computer. We *do not* expect your diagrams to be works of art, but we *do* expect them to be *neat*.

If you are unable to produce diagrams manually because of a disability, you should contact your tutor for advice.

Note the advice we give about diagrams in Block 1 and follow the guidelines below whenever you present a diagram in an assignment. There is also valuable advice in *SGSG* Chapter 3 Section 4.

- *Keep it simple and clear:* think carefully about how much detail is required to illustrate your answer and try to avoid things that are irrelevant.
- *Use clean solid lines*, even for sketches: it is better to use a *sharp* pencil than a pen, in case you want to make changes; use a ruler when drawing straight lines.
- *Label the important features:* it is often better to locate labels outside the area of the diagram and to use a straight line to connect the label to the feature to which it refers. If necessary, include a key to any colours, etc., and a scale.
- *Give your diagram a title or caption:* when you use more than one diagram, number each of them sequentially so that you can refer to them easily.
- Remember to *refer to your diagram within the text of your answer.*
- A diagram should be *your own work:* you may *base* it on a diagram from the course materials but it is unlikely to be suitable without modification. Your tutor is unlikely to award many marks for a diagram that is simply copied from the book without modification.

General presentation of assignments

You can either hand-write your assignments or you can use a word-processor (or typewriter), whichever you find easier and more convenient. As long as your answers are clearly legible and well laid out you will get the same number of marks. As well as leaving a wide margin, space out your answers to allow your tutor room to comment. (Your tutor may give you instructions about this.)

Setting out calculations is usually done more quickly and reliably by hand. If, however, you choose to word-process your answers you should bear the following points in mind.

- It is important that any numbers and units you use in calculations, etc. are set out *correctly*, as in the course materials. You should use correct scientific notation; subscripts, superscripts and symbols should be put in by hand if they cannot be printed correctly.
- Be particularly careful with the way you set out calculations. Even if you word-process the main text of an assignment, you may find it simpler to leave a gap so that you can write in equations by hand.

Sending in your TMA

Follow the instructions at the start of each TMA. Please also see 'Submitting TMAs' in the *Assessment Handbook*.

You should post your TMA to your tutor in sufficient time to arrive by the cut-off date. *Do not* send it using recorded delivery or guaranteed delivery; this can cause problems for tutors who are not at home to receive it. Instead send it by first-class post and ask for a *proof of posting certificate* at the post office and, if possible, keep a copy of the assignment.

If, for any reason, you are unable to complete your assignment on time, you *must* contact your tutor *before* the cut-off date to discuss possible options. The procedure for late submission of assignments is given in the *Assessment Handbook. Your tutor has the right not to give you a score for your assignment if you do not follow this procedure.*

What to do when your marked TMA is returned

Your tutor will assess your work according to a set of guidelines provided by the Course Team and will give constructive comments on your answers. When you get your TMA back, it is worth spending some time studying these comments carefully.

Probably the first thing you will be interested in is the mark! The score for each question and the overall score (as a percentage) for the TMA will be indicated in the appropriate boxes on the PT3 form. Below this your tutor will make general comments about your performance on the TMA and will give some general advice on how you might improve your score on the next TMA. Your tutor will also make more detailed comments, probably on the script itself, but sometimes on a separate sheet. The marks for each part of your answer will also be indicated on the script. Note that you will *not* be given a mark for TMA 01.

You will find various kinds of comment. Your tutor may have:

- commended something you did well, and explained why it was so good;
- corrected a specific mistake;
- written some general advice on how to tackle a particular kind of task;

- referred you to particular parts of the course material or to *SGSG* where you can find more help;
- asked about how you were developing your learning skills.

All these comments are made specifically for your benefit; they should provide valuable feedback on your work, and you can use this feedback to improve what you do in the next TMA. So before you file your TMA away in your Study File, it is important that you read carefully through *all* the comments and think about the implications that the advice has for your next TMA. And you will find it useful to review these comments when you come to do your next TMA.

General advice about S103 assignments: Part 2

We hope that when doing TMA 01 you followed the advice we gave you in 'General advice about S103 assignments: Part 1' above. In this second part we give some general advice about significant figures, how you go about deciding which equation(s) to use to solve a particular problem, and the use of units. You should read this advice before tackling TMA 02 and subsequent TMAs.

Significant figures in calculations

In Box 2.1 of Block 2, we introduced the idea of significant figures, and subsequently we have emphasized the importance of quoting the answers to calculations to the appropriate number of significant figures. The calculations in the questions and activities, particularly in Block 5, provide plenty of practice at doing this. However, when you do a series of calculations in which each succeeding step uses the answer from the previous step, you need to be careful that you don't 'lose' significant figures along the way. To avoid this, it is good practice to retain an extra digit in intermediate steps in a calculation – the first non-significant figure – and to use this extra digit in subsequent steps of the calculation. Here's an example to make it clear why this is important.

Question

The density of gold is 1.928×10^4 kg m^{-3}.

(a) What is the mass of a gold brick that has a volume of 2.2×10^{-3} m^3?

(b) What is the mass of 16 of these bricks?

Answer

(a) Density = mass/volume, so mass = density × volume. So, the mass of one brick = 1.928×10^4 kg m^{-3} $\times$ 2.2×10^{-3} m^3 = 42.416 kg = 42 kg to 2 sig figs.

Here we have quoted the answer to two significant figures because the volume of the brick was given to only two significant figures.

(b) We will calculate the mass of 16 bricks in two slightly different ways. First, we will use the two-significant-figure answer for the mass of a brick (i.e. 42 kg):

mass of 16 bricks = 16 × 42 kg = 672 = 670 kg to 2 sig figs

Now we will use the value of 42.416 kg to calculate the mass of 16 bricks:

mass of 16 bricks = 16 × 42.416 kg = 678.656 kg = 680 kg to 2 sig figs

Note that the answers that we get by the two methods are different, and this difference arises because of the rounding of the intermediate answer to two significant figures. The second answer is the better answer, because it is the result we would get by combining the first and second parts of the calculation, i.e.

$$\text{mass of 16 bricks} = 16 \times 1.928 \times 10^4 \text{ kg m}^{-3} \times 2.2 \times 10^{-3} \text{ m}^3$$
$$= 678.656 \text{ kg} = 680 \text{ kg to 2 sig figs}$$

Now, you clearly don't want to go back to the start of the calculation for each successive step, nor do you want to write down all of the digits that are displayed by your calculator and re-enter them for successive steps in the calculation. So a good practice to follow is to retain one extra digit for use in later steps of a calculation. In the gold brick example:

$$\text{mass of one brick} = 1.928 \times 10^4 \text{ kg m}^{-3} \times 2.2 \times 10^{-3} \text{ m}^3$$
$$= 42.4 \text{ kg} = 42 \text{ kg to 2 sig figs}$$

Note that here we first recorded one extra digit beyond the two significant figures that are justified by the data, i.e. we recorded 42.4 rather than just 42. We then use the value 42.4 kg in the next step, rather than 42 kg:

$$\text{mass of 16 bricks} = 16 \times 42.4 \text{ kg} = 678.4 \text{ kg} = 680 \text{ kg to 2 sig figs}$$

So here are the general rules to follow when doing a series of calculations.

> At each intermediate step, first write down (at least) one extra digit beyond the number of significant figures that are justified by the data. (If you are asked to present this as an answer to a part of a question, quote this intermediate answer to the appropriate number of significant figures.)
>
> In the next step in the calculation, use the unrounded number (with the extra digit) in the calculation. The final answer to a question should be quoted to the appropriate number of significant figures.

Deciding which equation is relevant to a particular problem

One of the difficulties that you may have when tackling problems in assignment questions is deciding which equations are relevant. Fortunately, it is not essential in this course for you to *remember* any equations, because you can always refer to the course books or to your own notes when you answer assignment questions.

There are a number of things that you can do to make it easier to select the appropriate equations.

- Make your own glossary of important equations and symbols. You will be asked to do this in Activity 3.2 in Block 5, but this activity can usefully be extended to cover all of the equations that you meet in the course. The advantage of having such a glossary is that all of the equations are then in one place.
- Make sure that you know the meanings of all of the symbols in these equations. Noting down these meanings alongside the equations will help you to recall them.

- When faced with a problem to solve, note down in words the quantities that you are given in the question and the quantities that you are asked to calculate, and write the conventional symbol for each alongside. Then look through your list of equations for those that involve the symbols that you have written down. Sometimes this will lead you directly to the one equation that you need to solve the problem. On other occasions you will find several equations that are relevant and that need to be combined in the ways described in Box 3.3 in Block 5.

Using units

At first, many students find using units inconvenient. However, the units are every bit as important as the value, as they give context to the value and ensure that calculations are dimensionally correct. For example, saying 'the length of the object is 3' is meaningless, whereas saying 'the length of the object is 3 m' tells us what we need to know. You should *always* check that you have used the correct units throughout your calculations. Furthermore, ensure that you leave a space between units when appropriate: for example, you should always write m s^{-1} or kg m^{-3} rather than ms^{-1} or kgm^{-3}.

Learning outcomes for S103

Each of the questions in these TMAs indicates which of the learning outcomes for the course (listed below, reprinted from the Appendix in the *Course Guide*) are being assessed.

Knowledge and understanding

In the context of the topics covered in S103, you should be able to demonstrate knowledge and understanding of:

1 the terminology, nomenclature, classification systems, conventions and units used in biology, chemistry, Earth sciences and physics, appropriate to study at this level;

2 some of the underlying facts, concepts, principles and theories associated with the study of science;

3 methods of acquiring, interpreting and analysing scientific information.

4 the processes that shape the natural world at different time-scales and scales of size;

5 the benefits of a multidisciplinary and interdisciplinary approach in advancing scientific knowledge and understanding;

6 the contribution of science to informed debate about some aspects of environmental and social issues.

Cognitive skills

On completion of S103, you should also be able to:

1 make sense of information presented in a variety of ways, including text, tables, graphs, diagrams and figures, numerical and mathematical descriptions, and computer-based multimedia;

2 understand and make use of the facts, concepts, principles and theories relating to the main subject areas in science;

3 apply your knowledge and understanding of scientific concepts to address familiar and unfamiliar problems;

4 describe, analyse and interpret scientific information and data.

5 make links/connections and recognise associations/relationships among different subject areas;

6 understand the use of simple analogies and models in order to explain scientific concepts;

7 classify an appropriate range of organisms, objects and/or systems on the basis of similarities and differences.

Key skills

On completion of S103, you should also be able to:

1 communicate scientific topics clearly and concisely, using methods appropriate to your purpose and audience;

2 use mathematical skills appropriate to the study of science at this level;

3 solve numerical problems using non-computer based methods;

4 process, interpret and present data using appropriate qualitative and quantitative techniques;

5 plan and implement efficiently, effective ways of working, so demonstrating time-management and organizational skills;

6 reflect on the experience of learning in order to develop more effective learning strategies.

Practical and/or professional skills

On completion of S103, you should also be able to:

1 handle materials safely by complying with safety instructions and being aware of any specific hazards associated with the use of the materials;

2 make and record appropriately, observations and measurements of a quantitative and qualitative nature;

3 consider issues of accuracy, precision and uncertainty in the recording and analysing of data;

4 interpret data derived from laboratory and field observations and measurements in terms of the appropriate underlying scientific theories.

Tutor Marked Assignment S103 01

Covering: Block 1

Cut-off date: Tuesday 13 February 2007

Completing your TMA

Use A4 size paper for your assignment, and leave a wide margin for your tutor's comments. Put your name, personal identifier, and the course code and assignment number at the top of every sheet.

Sending in your TMA

You must attach the TMA form (PT3), enclosed with the course materials, to your assignment when you send it to your tutor. You should complete Section 1 of the form, taking particular care to enter correctly your personal identifier, the course code and the TMA number, as described in 'Submitting TMAs' in the *Assessment Handbook*. Before mailing, make sure that you have put your name and address on the envelope. *Do not* send the TMA to your tutor using recorded or guaranteed delivery. *Do* make sure that you obtain a proof of posting certificate and, if possible, that you have kept a copy of your TMA.

Introduction

The purpose of this assignment is to enable you to practise writing answers to short questions and to receive feedback on your answers from your tutor. This feedback will be the first assessment of your work that your tutor gives and is an excellent opportunity for you to learn where your strengths and weaknesses lie. Crucially, it will enable you to work on any weaknesses before you tackle TMA 02 (the first TMA that counts towards your final course score). Please note that you will *not* receive a mark for this TMA.

You should attempt this assignment as soon as you have completed your study of Block 1 and send it to your tutor. Your assignment and your tutor's comments will be returned to you after the cut-off date. Note that the cut-off date is the *final* date by which your tutor should receive your script. You need to make sure that you post it in plenty of time to reach your tutor by this date.

You can choose to hand-write your answers, to use a word-processor, or to use a combination of the two methods. However, if you decide to use word-processing software, it is important that you set out any numbers and units correctly, as in Book 1. Unless you can do this easily on your word-processor, you will find it easier and faster to hand-write any calculations. This will also avoid any formatting errors. As well as leaving a wide margin, space out your answers to allow your tutor room to comment.

This assignment consists of four questions that relate to Block 1. Each question indicates which block objectives are being tested and the general learning outcomes that it will help you to achieve. The assignment is shorter than those you will meet later in S103 (about half the length) and easier than the later TMAs. However, it does give you a good introduction to S103 assignments and allow your tutor to give you advice on how to improve your answers.

Question 1

This question relates mainly to Objectives 6 and 17–22 of Block 1. It will also help with your achievement of the following general learning outcomes for S103 (see pages 10–11 of this booklet).

Knowledge and understanding skills: outcome 1

Cognitive skills: outcome 1

Key skills: outcomes 1–3

Present your answers to the following calculations, showing clearly all the steps by which you arrived at your answer. Set out your answers so that they are easy to read and contain enough written information to make clear each step in your calculations. You could use our answer to Question 2.11 in Block 1 as a guide. The method of a calculation is more important than the final answer. Be sure to include units at *all stages* of each calculation.

(a) If rice contains 5% fat, how much fat is there in 0.6 kg of rice? Give your answer in grams.

(b) When driven 'normally', the fuel consumption of a car is 7.5 litres per 100 km. On a particular journey of 350 km the car is driven 'hard' and the consumption changes to 9.1 litres per 100 km. Assume fuel costs 98 p per litre. *Calculate* (i) the *extra* fuel consumed, and (ii) the *extra* cost of fuel, in pounds, for the journey when the car is driven 'hard'.

(c) A rectangular slab of granite, 0.45 m by 0.35 m, is 5.0 cm thick and has a mass of 21.7 kg. What is the density of the granite? Give your answer in scientific notation, with the decimal number expressed to one decimal place.

Question 2

This question relates mainly to Objectives 13 and 15 of Block 1. It will also help with your achievement of the following general learning outcomes for S103 (see pages 10–11 of this booklet).

Knowledge and understanding skills: outcomes 1 and 3

Cognitive skills: outcomes 1 and 4

Professional and practical skills: outcome 4

A glass ball was allowed to fall freely through silicone oil in a glass cylinder. The graph in Figure 1 (overleaf) shows the height of the ball above the base of the cylinder at certain times after its release. Study the graph carefully, then answer the following questions, and include units where appropriate. Set out your answers clearly, and fully. **Note:** you should answer in whole sentences (rather than just writing down a number, for example).

(a) From what height was the ball dropped? Give your answer in centimetres.

(b) How long did it take the ball to reach the base of the cylinder?

(c) What was the height of the ball after 4.0 s? Give your answer in metres in scientific notation.

(d) Summarize, *in one or two sentences*, the information that you can deduce from the graph about the motion of the ball.

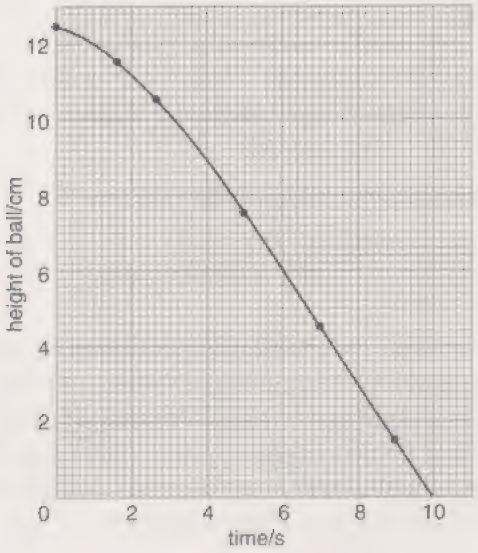

Figure 1 The height of a glass ball above the base of a cylinder of silicone oil at various times after it was released.

Question 3

This question relates mainly to Objectives 3, 5 and 15 and 16 of Block 1. It will also help with your achievement of the following general learning outcomes for S103 (see pages 10–11 of this booklet).

Knowledge and understanding skills: outcomes 1, 2 and 4

Cognitive skills: outcomes 1 and 2

Key skills: outcome 1

Describe briefly the process of sweating in humans and explain how sweating cools the human body. (*Your answer should be no more than 120 words.*)

When writing a short account such as this, the following guidelines will help.

- You *must* answer in your own words.
- Underline the words in the question that tell you what to do. In this question these are 'describe' (i.e. paint a picture in words – no explanation required) and 'explain' (your response should answer the unwritten questions 'How?' and 'Why?'; in other words, you are giving reasons).
- Note the number of parts to the question and make sure that you answer them all; here there are two, although both are presented in this same sentence.
- Highlight the key words, e.g. **process** and **sweating** (in the first part of the question) and **cools** (in the second part of the question). Make sure that you bring out the meaning of the words in your answer, or define them; for example, to describe the process of sweating you need to define 'sweat'.
- Assume that you are writing for a fellow student who does not know the science, and that way you will give a full explanation and will also remember to state the obvious!

Your tutor will give feedback on how well you have achieved the following:

- an accurate scientific explanation;
- clarity, including sentence construction and absence of ambiguities;
- coherence – points made in a logical order;
- conciseness – keeping to the word limit and avoiding redundant words or phrases and irrelevant points.

In your answer you should use your own words and not simply copy from the course text. In later TMAs, you will lose marks for copying significant portions of the text from the course books.

Question 4

This question relates mainly to Objective 24 of Block 1. It will also help with your achievement of the following general learning outcome for S103 (see pages 10–11 of this booklet).

Key skills: outcome 6

This question is quite different from the previous three questions in this assignment. It asks you to think about the way in which you studied Block 1 and, in doing this, you will build on some of the activities in the block, particularly Activity 7.1. The reason for this 'reflective' question, and for reflective activities in the Study File, is that reflecting on the ways you learn, and evaluating what works and what doesn't work for you, can be a powerful way of improving the effectiveness and efficiency of your studying.

Spend a few minutes thinking about how your study techniques (such as those listed in Objective 24) have changed as a result of your experience of studying Block 1. Also, think about any further changes that you plan to implement when you study Block 2. Then:

(a) make a *list* of these changes;

(b) for one or two of the changes that you regard as most important, *explain* the reasons why you made (or will make) the changes.

For example, you may have decided that you need to highlight fewer words and phrases because, when you went back to a section (to write an answer to an activity), you found you had highlighted so much that you had to reread the section in order to pick out the main points.

There are no right and wrong answers to this question. Your tutor will be looking for evidence that shows you have thought about how you studied. There is no word limit for your answer but about 70 to 120 words is probably appropriate for part (b).

Before sending your assignment to your tutor, make sure that you have:

- put your name, personal identifier, course and assignment number at the top of every sheet;
- attached a PT3 form, with Section 1 completed;
- put your name and address on the envelope.

Send the assignment by normal first-class post (or second class, if there is time for it to be delivered before the submission date). *Do not* send it by recorded or guaranteed delivery, as your tutor may not be at home to sign for it. Ensure the cost of postage is adequately covered (this is particularly relevant to UK students since the Royal Mail pricing system changed).

Tutor Marked Assignment S103 02

Covering: Block 2

Cut-off date: Tuesday 13 March 2007

Completing your TMA

Use A4 size paper for your assignment, and leave a wide margin for your tutor's comments. Put your name and personal identifier, and the course code and assignment number, at the top of every sheet.

Sending in your TMA

You must attach the TMA form (PT3), enclosed with the course materials, to your assignment when you send it to your tutor. You should complete Section 1 of the form, taking particular care to enter your personal identifier, the course code and the TMA number, as described in 'Submitting TMAs' in the *Assessment Handbook*. Before mailing, make sure that you have put your name and address on the envelope. *Do not* send the TMA to your tutor using recorded or guaranteed delivery. *Do* make sure that you obtain a proof of posting certificate and, if possible, that you have kept a copy of your TMA.

Introduction

This is the first of the seven S103 assignments for which the marks contribute to your overall course score. It is very important that you get the benefit of your tutor's comments at an early stage in the course, so TMA 02 is *non-substitutable*. **It is therefore essential that you attempt it.**

For this early TMA, we have used mainly short questions and we have often included a lot of explanatory text in the questions to help lead you through. The disadvantage of this is that, at first glance, the TMA probably looks longer and more involved than it really is. Don't be put off! Just start Question 1 and you will be surprised at your progress.

This assignment consists of six questions that relate to Block 2 (although objectives from Block 1 may also be tested).

Questions 2 and 4 involve drawing by hand. Marks will be awarded for these diagrams and you will be penalized if you produce computer-drawn diagrams, or images that have been scanned into your computer. If you are unable to draw by hand, because of a disability, you may, after consultation with your tutor, submit computer-drawn diagrams or diagrams produced by your amanuensis.

Question 1

This question relates mainly to Objectives 21, 30 and 31 of Block 2, and carries 20% of the marks for this assignment. It will also help with your achievement of the following general learning outcomes for S103 (see pages 10–11 of this booklet).

Knowledge and understanding skills: outcomes 2 and 3

Cognitive skills: outcome 4

Key skills: outcomes 2–4

Practical and/or professional skills: outcomes 3 and 4

(a) (*12 marks*) In Activity 2.1, you were asked to construct a rain gauge and to measure the daily precipitation in order to calculate the *mean* daily precipitation over a period of several weeks. Factors such as the design, construction and site of your gauge, and how and when you took the readings, have the potential to lead to uncertainties in the measured level of water in the container (see comments on Tasks 1, 2 and 7, Activity 2.1).

Table 1 (overleaf) gives one example of a potential source of uncertainty, how the results of the experiment would be affected, the type of uncertainty that this constitutes, and the steps you might have taken to avoid or reduce the uncertainty. Complete the appropriate columns in Table 1 by:

(i) adding *three* more potential sources of uncertainty in your experimental procedure, *at least one* of which might have led to a *systematic* uncertainty in your results, and *at least one* of which might have led to a *random* uncertainty;

(ii) indicating whether the source of each uncertainty would have led to the level of the water in your container possibly being *higher* than it should be or *lower* than it should be, or whether it is not possible to predict whether the level would be lower or higher;

(iii) *stating*, for each potential source, which *type* of uncertainty (systematic or random) would have arisen;

(iv) *outlining* the steps you took in your experimental procedure – or might take if you repeated the experiment – to avoid or reduce the uncertainties that you have identified. (*One or two sentences*)

If circumstances meant you were unable to avoid or reduce a particular uncertainty that you have identified, you should state why this was. **There is a copy of Table 1 on page 29, which you can complete and cut out to send to your tutor with the rest of your TMA answers.**

(b) (*8 marks*) Based on *your* results from the rain gauge experiment *with the funnel* in Activity 2.1, what was the mean daily precipitation for the period over which you took measurements? To answer this question, you should show your original data, and then show the stages by which you have arrived at your answer (see Task 6, Activity 2.1) Include an estimate of the uncertainty in your final value for the mean daily precipitation. **If you had difficulty collecting rain water over the period concerned, you should contact your tutor who will advise you.**

Table 1 Sources of uncertainty in recording levels of precipitation, together with their effects and steps taken to avoid or reduce them.
(*For use with TMA 02 Question 1.*)

(i) **Source of uncertainty**	(ii) **Effect on water level in container**	(iii) **Type of uncertainty (systematic/random)**	(iv) **Steps taken to avoid/ reduce uncertainty**
loss of water by evaporation	lower	systematic	used a funnel to collect the water

Don't forget to send your completed Table 1 on page 29 to your tutor with the rest of your TMA answers.

Question 2

This question relates mainly to Objective 23 of Block 2, and carries 7% of the marks for this assignment. It will also help with your achievement of the following general learning outcomes for S103 (see pages 10–11 of this booklet).

Knowledge and understanding skills: outcome 3

Cognitive skills: outcome 1

Key skills: outcomes 1, 2 and 4

This question will help you develop and demonstrate your ability to plot data. Table 2 shows the UK mean monthly precipitation during 2005. (These data are released by the UK Meteorological Office, based on results from many observing stations from all over the UK.) *Plot by hand* (i.e. without the use of a computer) the data from Table 1 *as a histogram* on the graph paper on page 31 of this booklet. You can use Box 7.1 and Figure 7.3 in Block 2 and pp. 62–63 in *SGSG* to help you (you do not need to write numbers above each column). Suitable axes have already been prepared, which allow the graph to fill the graph paper with convenient scales. Marks will be awarded for the *accuracy with which you plot the data* and for the *neatness of your finished histogram.* You should include appropriate *labels for the axes* and a *title* that indicates clearly what the histogram shows.

Do not forget to send your completed graph to your tutor with your TMA.

Table 2 UK mean monthly precipitation recorded in 2005.

Month	Mean UK precipitation in each month during 2005 /mm
January	127
February	70
March	73
April	91
May	73
June	72
July	60
August	85
September	93
October	143
November	117
December	81

Question 3

This question relates mainly to Objectives 8, 13, 18, 20, 22, 26, 29 and 38 of Block 2, and carries 25% of the marks for this assessment. It will also contribute to your achievement of the following general learning outcomes for S103 (see pages 10–11 of this booklet).

Knowledge and understanding skills: outcomes 2, 3 and 6

Cognitive skills: outcomes 1, 4 and 6

Key skills: outcomes 1– 3

Practical and/or professional skills: outcome 2

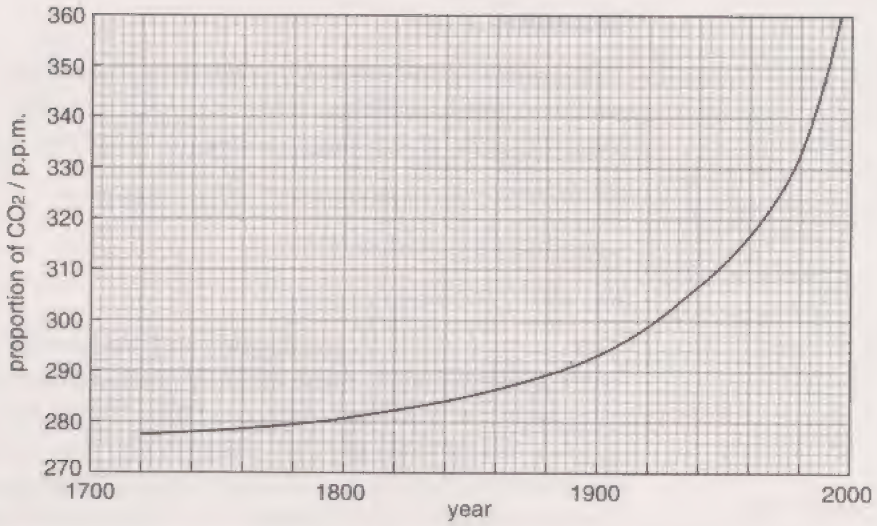

Figure 1 The proportion of carbon dioxide in the Earth's atmosphere over the last 250 years.

Figure 1 shows the overall trend of the proportion of carbon dioxide in the Earth's atmosphere over the past 250 years or so. (The data on which the graph is based are also shown in Figure 8.10 in Block 2.)

(a) (*8 marks*) Using the smooth curve in Figure 1, produce *a table* that shows the proportion of carbon dioxide in the Earth's atmosphere at 50-year intervals from 1740 to 1990 (inclusive).

(b) (*4 marks*) Use the values in your table from part (a) to *calculate* the increase in the proportion of carbon dioxide between 1740 and 1790, and the increase between 1940 and 1990. What is the ratio of the increase in the first of these periods to the increase in the second period? (Give your answers to an appropriate number of significant figures.)

(c) (*13 marks*) This part requires you to obtain data from the DVD multimedia activity 'Global warming and cooling' (Block 2 Activity 9.2). You should use the model in the section 'Coupling between factors'. The default values in this model are those for the early 1990s, so the carbon dioxide value that you obtained in (a) for 1990 should be similar to the default value in the model.

(i) *Write down* the values for the GMST when the carbon dioxide content of the atmosphere has the values that you recorded in your table in part (a) for 1990 and 1940, respectively, with the other six factors initially set at their default values. (Note, you may not be able to set the carbon dioxide content to exactly the values you recorded in your table, because the slider changes in discrete steps; use the value that is closest to that in your table.)

(ii) Hence *calculate* the *change* in GMST predicted by the model if the carbon dioxide content reverted from its 1990 level to its 1940 level.

(iii) Which other factors in the model change when the carbon dioxide content is changed from the 1990 level to the 1940 level, and by how much do these factors change?

(iv) *Explain why* the factors identified in part (iii) change when the carbon dioxide content changes. (*Two or three sentences*)

Question 4

DIAGRAM TO DO

This question assesses Objectives 13, 26 and 27 of Block 2, and carries 14% of the marks for this assessment. It will also contribute to your achievement of the following general learning outcomes for S103 (see pages 10–11 of this booklet).

Knowledge and understanding skills: outcomes 1 and 2

Cognitive skills: outcomes 2, 5 and 6

Key skills: outcome 1

Although methane is only a trace constituent of the Earth's atmosphere, its effect as a greenhouse gas is significant. With the aid of a *hand-drawn* diagram, *explain why and how* the molecular structure of methane enables it to act as a greenhouse gas. (*Three or four sentences*)

Marks will be awarded for the neatness of your diagram, as well as its effectiveness in communicating information.

Question 5

This question assesses Objectives 1– 4, 25, 26 and 28 of Block 2, and carries 29% of the marks for this assessment. It will also contribute to your achievement of the following general learning outcomes for S103 (see pages 10–11 of this booklet).

Knowledge and understanding skills: outcomes 1– 6

Cognitive skills: outcomes 1, 2, 4 and 5

Key skills: outcome 1

Practical and/or professional skills: outcomes 3 and 4

Knowledge of past surface temperatures is an essential element in understanding the variability of climate from both natural and artificial causes. *Write a short account of about 300 words* (up to 350 is acceptable but do not go over this limit) explaining how GMST is measured and how past values are inferred. Information about the actual GMST values is not required. Your account, based on the course material in Block 2, should explain:

- the meaning of GMST;
- how GMST is currently measured;
- the nature of the historical temperature records and the implication for establishing reliable GMST values;
- the nature of constructed temperature records for times before the historical records began;
- how the older evidence is used to deduce temperature information.

In this particular account, an introduction and a conclusion are *not* required. At the end of your account, please *state* the number of words used.

Of the marks, 20 will be awarded for the scientific content and 9 for your written communication skills. These communication skills will be assessed for the achievement of the following outcomes.

Clarity and use of English: the discussion should be clear and free of ambiguity. Spelling, grammar and sentence construction should be correct, with the account divided appropriately into paragraphs.

Coherence: your argument should have a logical progression.

Conciseness: you should close to the recommended word count, ideally within 50 words, and ensure no irrelevant or redundant material is included.

Preparing your account

To successfully prepare your account you will probably need to go through the following steps:

- find and collect together relevant material;
- arrange your material in a linked fashion;
- check for relevance to the question;
- type or write the first draft of your essay;
- review, correct and edit it down.

You may find it helpful to collect together material and plan your account using one of the techniques discussed in Block 2. *SGSG* Chapter 9, Section 5.3 provides advice on this. Other parts of Chapter 9 of *SGSG* have suggestions for writing your account that may prove useful. *Note that Question 6 asks about the account planning process.*

Remember that it is important you write *in your own words*.

Question 6

This question relates mainly to Objectives 28 and 36 of Block 2, and carries 5% of the marks for this assignment. It will also help with your achievement of the following general learning outcomes for S103 (see pages 10–11 of this booklet).

Key skills: outcomes 5 and 6

Question 5 suggested five steps for preparing the account. You may have used these, some variation, or another route entirely. *Briefly describe* and *explain* the process you followed. If you wish, you may attach your original plan or use a diagram to illustrate the process you followed.

Comment on how successful you think your approach was. To what extent are you satisfied that the method will be appropriate for longer accounts of up to 1000 words, sourced from several different books or articles? *Discuss* any changes you might implement.

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Tutor Marked Assignment S103 03

Covering: Block 3

Cut-off date: Tuesday 10 April 2007

Completing your TMA

Use A4 size paper for your assignment, and leave a wide margin for your tutor's comments. Put your name and personal identifier, and the course code and assignment number, at the top of every sheet.

Sending in your TMA

You must attach the TMA form (PT3), enclosed with the course materials, to your assignment when you send it to your tutor. You should complete Section 1 of the form, taking particular care to enter your personal identifier, the course code and the TMA number, as described in 'Submitting TMAs' in the *Assessment Handbook*. Before mailing make sure that you have put your name and address on the envelope. *Do not* send the TMA to your tutor using recorded or guaranteed delivery. *Do* make sure that you obtain a proof of posting certificate and, if possible, that you have kept a copy of your TMA.

Introduction

This assignment consists of three questions that relate to Block 3. Each of the questions in this TMA indicates which of the block objectives (listed in the *Study File for Block 3*) is being tested and what percentage of the marks for the assignment is allocated to it.

You should bear in mind the detailed advice on how to tackle the S103 assignments given in the section 'General advice about S103 assignments: Part 1', on pp. 2–7 of this Assessment Booklet; you may wish to read the advice again before doing this assignment. You should also read carefully the 'General advice about S103 assignments: Part 2' on pp. 7–9 of this Assessment Booklet (deciding which equations to use, and further advice about significant figures). *You may be penalized for not paying attention to this advice, particularly in relation to presenting answers to calculations and including diagrams.* Also be sure to take account of any advice given by your tutor on TMA 02.

Having tackled the first two S103 assignments, now would be an appropriate time to read *SGSG* Chapter 9, Section 6 'Managing assignments', pp. 259–64. You might find it useful to read the following sections in *SGSG* on the use of diagrams: Chapter 3, pp. 56–60 and pp. 81–86.

Question 1

This question relates mainly to Objectives 34, 37 and 42 and parts of Objectives 30 and 40 of Block 3, and carries 25% of the marks for this assignment. It will also help with your achievement of the following general learning outcomes for S103 (see pages 10–11 of this booklet).

Knowledge and understanding skills: outcomes 1 and 3

Cognitive skills: outcomes 1– 4

Key skills: outcomes 2 and 3

A minibus was driven from rest in a straight line and came to rest again. On the minibus there was a student with a stopwatch who had to record the speed of the minibus at suitable moments in time. Figure 1 (opposite) shows her plot of the speed of the minibus against time. After plotting the graph, the student lost some of her data. Table 1 shows her incomplete record of data.

***Note:** this is an idealized set of data created for this TMA question. In reality, it is highly unlikely that the graph would pass exactly through all the data points. Also, the corners of the graph and B and C would probably be more rounded.*

Table 1 The speed of a minibus at various moments in time.

Time/s	Speed of minibus / m s^{-1}
0	0
10	3
20	
30	9
40	
	15
60	
70	
	10
90	
	0

(a) (*2 marks*) Using Figure 1, *calculate* how long the minibus journey took and the maximum speed of the minibus.

(b) (*4 marks*) Copy Table 1. Using information from Figure 1, *fill in* the missing data in this table.

(c) (*8 marks*) Examine the three distinct phases of the motion of the minibus (shown as the straight lines A–B, B–C and C–D on the graph). In which (if any) of these phases can the minibus be described as having:

(i) a constant value of speed;

(ii) a positive value of acceleration;

(iii) a negative value of acceleration;

(iv) a zero value of acceleration?

Briefly explain your answers to (i)–(iv).

(d) (*5 marks*) *Calculate* the distance travelled by the minibus during the phase of its motion shown as B–C in Figure 1.

(e) (*6 marks*) *Calculate* the magnitude of the acceleration of the minibus 40 s after the start of the journey. *Show* how you obtained your answer and give your answer to two significant figures.

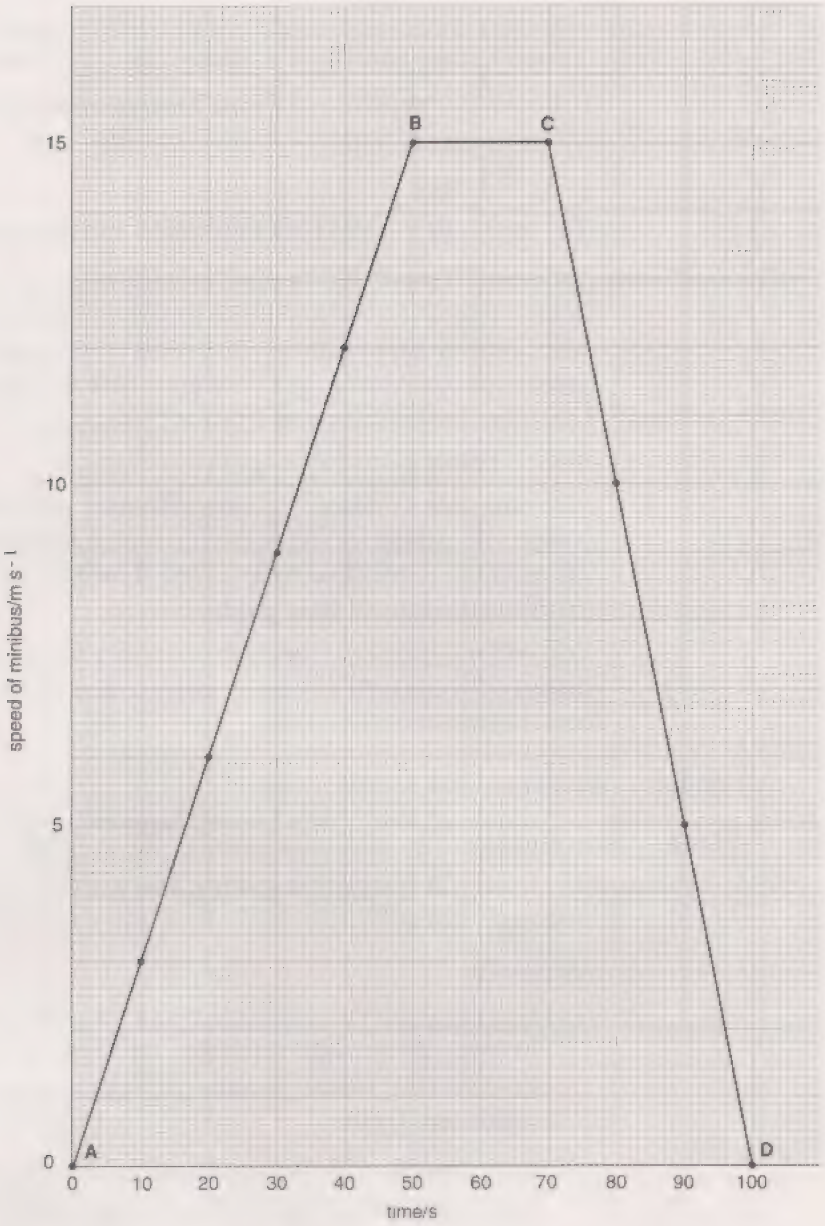

Figure 1 A graph of the speed of a minibus against time.

Question 2

This question relates mainly to Objectives 11–14, 27, 29, 30, 32, 34, 35, 37, 39, 40 and 42 of Block 3, and carries 53% of the marks for this assignment. It will also help with your achievement of the following general learning outcomes for S103 (see pages 10–11 of this booklet).

Knowledge and understanding skills: outcomes 1– 5

Cognitive skills: outcomes 1– 6

Key skills: outcomes 1, 2 and 4

Before starting this question, you are recommended to have studied Section 10 in considerable detail. In particular, you will find it useful to complete the DVD-ROM Activities 10.2, 10.3 and 10.5 (Block 3) 'Journey to the Centre of the Earth'.

(a) (*4 marks*) Earthquakes produce two types of seismic wave that travel within the body of the Earth (body waves), known as P and S waves.

Describe the properties of P and S waves in terms of:

(i) the type of motion or deformation they induce as they pass through solid rock;

(ii) their relative speed through solids, and through liquids.

(b) (*10 marks*) Table 2 shows some measurements of the time taken for P waves from a shallow-focus earthquake to arrive at different locations. *Construct* a travel-time graph by *plotting* these data on the graph paper provided on page 33 of this booklet, and drawing a best-fit line through the data points.

You may want to refer to Box 5.1.1 in Activity 5.1 in the *Study File for Block 2* before plotting the graph.

Plot your graph by hand on the graph paper provided. We recommend that you plot the points and draw the line with a sharp pencil so that corrections can easily be made if necessary. You should also include the origin (point (0, 0)) on the axes of your graph.

You will not gain any marks for producing the graph by computer unless you cannot draw the graph by hand, because of a disability, in which case please contact your tutor for advice.

Table 2 Travel time data for P waves.

Distance from epicentre / km	25	40	65	75	100	150	170	200
Travel time / s	3.5	5.0	9.5	11.0	14.0	21.0	24.0	27.5

(c) (*11 marks*)

(i) Use the graph you completed in (a) to *calculate* the speed of the P waves in the rocks through which they have passed. *Show all your working* and give the final answer in units of kilometres per second (km s^{-1}) to TWO significant figures.

(ii) On the basis of the P wave speed you have calculated, *state* whether the wave travelled mainly through continental crust, oceanic crust or the mantle.

(d) (*28 marks*) *Explain*, in your own words, how the information from studies of seismic waves can be used to deduce the structure and composition of the Earth's interior. Also *describe* two additional lines of evidence. You should support your answer with a simple cross-section from the surface to the centre of the Earth. The cross-section should summarize the structure, composition and properties of seismic waves, for each part of the Earth's interior (i.e. between different seismic discontinuities). (*About 250 words – up to 300 is acceptable – plus a diagram.*)

Diagrams can often convey a lot of information and, therefore, save on words because they are not counted in your written word limit. The diagram that you use should be (i) fully integrated into your account and (ii) fully labelled and have a title and scale (if appropriate) (see *SGSG*, page 85 'Hints and Tips' for useful advice on completing diagrams). If you base your diagram on any of the diagrams in Block 3 (or another source), remember to acknowledge that source. If you cannot produce diagrams by hand, because of a disability, please contact your tutor for advice.

It is important that you pay attention to the construction of your argument, the clarity, coherence and conciseness of your writing, and your spelling and grammar because these are important aspects of mastering good written communication skills. You should write to within the word limit set in the question. To help your tutor, please state the approximate number of words you have used at the end of your account.

Marks allocation

- 13 for the scientific content of the written account
- 6 for the diagram
- 9 for the quality of written communication skills
-

Question 3

This question relates mainly to Objectives 1, 8, 10, 18 and 25 of Block 3, and carries 22% of the marks for this assignment. It asks you to compare, contrast and describe different phenomena, an approach that will be used in many later TMAs. It will also help with your achievement of the following general learning outcomes for S103 (see pages 10–11 of this booklet).

Knowledge and understanding skills: outcomes 1 and 4

Cognitive skills: outcomes 2 and 3

Key skills: outcome 1

(a) (*9 marks*)

(i) *Describe* what causes an earthquake. (*One or two sentences*)

(ii) Earthquake size can be measured in terms of *intensity* or *magnitude*. *State* what is measured in each case and *indicate* the main difference between the two scales used to record measurements. (*One or two sentences for each*)

(b) (*9 marks*) *Compare* and *contrast* sedimentary rock and metamorphic rock, in terms of (i) their characteristic features and (ii) the ways in which they are formed. (*No more than 100 words*)

(c) (*4 marks*) At what type of plate boundary or plate tectonic setting would you expect to find the following? (*One sentence for each*)

(i) The highest magnitude earthquakes

(ii) Metamorphic rocks being formed

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- attached a PT3 form, with Section 1 completed;
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Table 1 Sources of uncertainty in recording levels of precipitation, together with their effects and steps taken to avoid or reduce them.
(*For use with TMA 02 Question 1.*)

(i) **Source of uncertainty**	(ii) **Effect on water level in container**	(iii) **Type of uncertainty (systematic/random)**	(iv) **Steps taken to avoid/ reduce uncertainty**
loss of water by evaporation	lower	systematic	used a funnel to collect the water

Don't forget to send your completed Table 1 to your tutor with the rest of your TMA answers. Fill in your Personal Identifier in the grid below.

Personal Identifier								

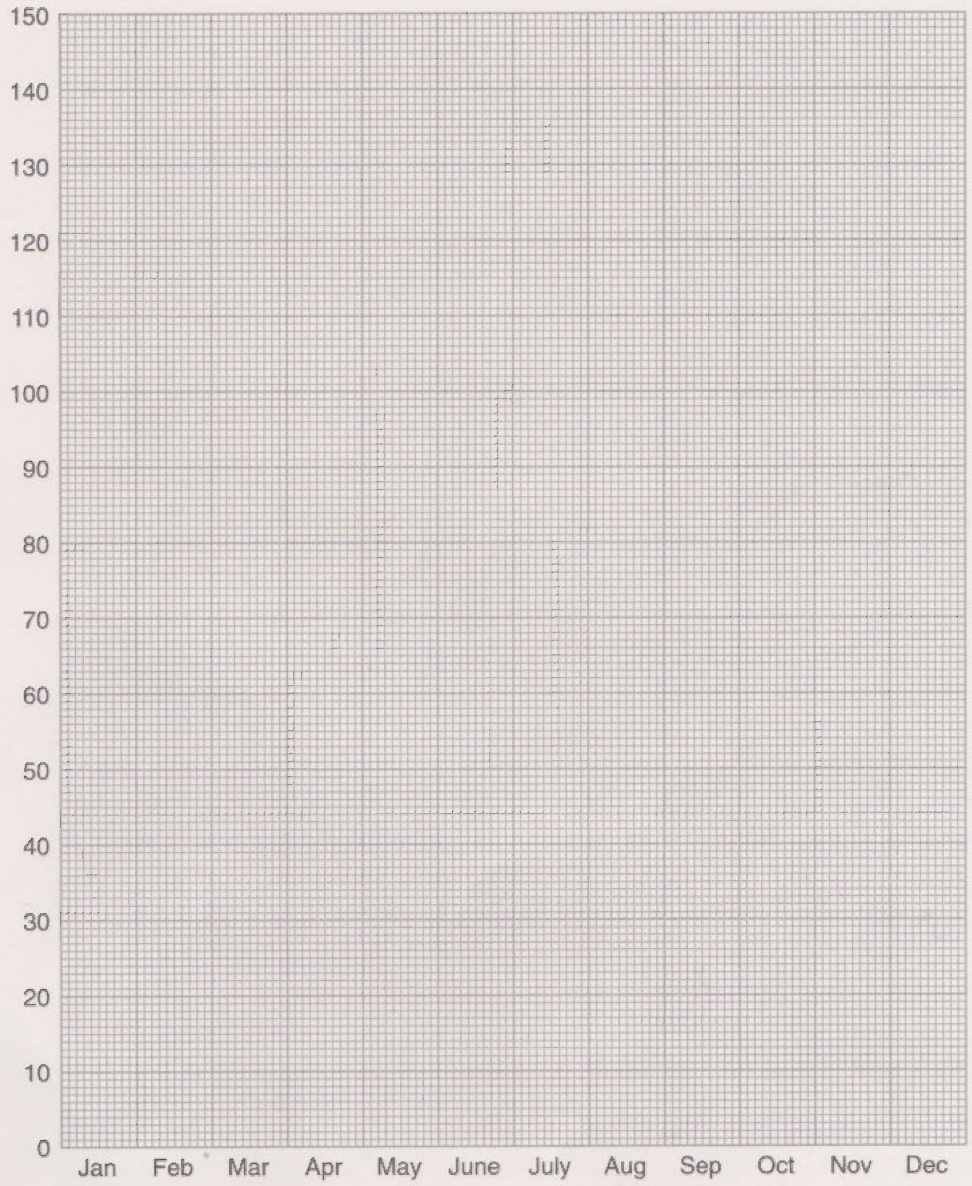

Figure for use with TMA 02 Question 2.

Remember to cut out your completed graph and send it to your tutor with your TMA. Fill in your Personal Identifier in the grid below.

Personal Identifier								